WHAT IS CLAIMED IS:

1. An expression cassette comprising a preselected first DNA segment encoding an enzyme which catalyzes the synthesis of an osmoprotectant, operably linked to a promoter functional in a host cell, wherein the promoter is selected from the group consisting of the *Glb* promoter, the *Adh1* promoter, and the *Act1* promoter.

2. The expression cassette of claim 1 wherein the osmoprotectant is a sugar.

3. The expression cassette of claim 2 wherein the osmoprotectant is a sugar alcohol.

4. The expression cassette of claim 2 wherein the osmoprotectant is a sugar selected from the group consisting of fructose, erythritol, sorbitol, dulcitol, glucoglycerol, sucrose, stachyose, raffinose, ononitol, mannitol, inositol, methyl-inositol, galactol, hepitol, ribitol, xylitol, arabitol, trehalose, and pinitol.

5. The expression cassette of claim 1 wherein the osmoprotectant is selected from the group consisting of proline and glycine-betaine.

6. The expression cassette of claim 1 wherein the enzyme catalyzes the synthesis of a sugar.

7. The expression cassette of claim 6 wherein the enzyme catalyzes the synthesis of mannitol.

8. The expression cassette of claim 1 further comprising a second DNA segment encoding an amino terminal chloroplast transit peptide which is operably linked to the preselected first DNA segment.

9. The expression cassette of claim 8 wherein the chloroplast transit peptide is a maize chloroplast transit peptide.

10. The expression cassette of claim 1 which further comprises an enhancer element.

11. The expression cassette of claim 10 wherein the enhancer element is subject to tissue-specific regulation.

12. The expression cassette of claim 1 which further comprises a selectable marker gene or a reporter gene.

13. An expression cassette comprising (a) a preselected first DNA segment encoding an enzyme which catalyzes the synthesis of an osmoprotectant, operably linked to a promoter functional in a host cell; and (b) a second DNA segment that encodes an untranslated regulatory element, wherein the second DNA segment separates the preselected DNA segment from the promoter.

14. The expression cassette of claim 13 wherein the untranslated regulatory element is the *Adh*I intron 1.

15. The expression cassette of claim 13 wherein the promoter is turgor-inducible.

16. The expression cassette of claim 13 wherein the promoter is abscisic acid inducible.

17. The expression cassette of claim 13 wherein the promoter is developmentally regulated.

18. The expression cassette of claim 13 wherein the promoter is a constitutively expressed promoter.

19. The expression cassette of claim 13 wherein the promoter is subject to tissue-specific regulation.

20. The expression cassette of claim 13 wherein the promoter is water-stress inducible.

21. An expression cassette comprising (a) a preselected first DNA segment encoding an enzyme which catalyzes the synthesis of an osmoprotectant, operably linked to a promoter functional in a host cell; and (b) a second DNA segment encoding a maize chloroplast transit peptide, wherein the second DNA segment is operably linked to the preselected first DNA segment.

22. A method to increase water stress resistance or tolerance in monocot plant cells, comprising:

(a) introducing into cells of a monocot plant an expression cassette comprising a preselected first DNA segment encoding an enzyme which catalyzes the synthesis of an osmoprotectant, operably linked to a promoter functional in the monocot plant cells, to yield transformed monocot plant cells; and

(b) expressing the enzyme encoded by the preselected first DNA segment in the transformed monocot plant cells so as to render the transformed monocot plant cells substantially tolerant or resistant to a reduction in water availability that inhibits the growth of untransformed cells of the monocot plant.

23. The method according to claim 22 wherein the expression cassette is introduced into the plant cells by a method selected from the group consisting of electroporation, protoplast transformation, and microprojectile bombardment.

24. The method according to claim 22 wherein the cells of the monocot plant comprise cells of callus, immature embryos, gametic tissue, meristematic tissue or cultured cells in suspension.

25. The method according to claim 22 wherein the expression cassette further comprises a second DNA segment encoding an amino terminal chloroplast transit peptide which is operably linked to the preselected first DNA segment.

26. The method according to claim 25 wherein the second DNA segment encodes a maize chloroplast transit peptide.

27. The method according to claim 25 wherein the enzyme is expressed in the cytosol of the cells of the transformed monocot plant.

28. The method according to claim 25 wherein the enzyme is expressed in the chloroplasts of the cells of the transformed monocot plant.

29. A transformed plant regenerated from the transformed plant cells obtained by the method of claim 25.

30. A transformed seed of the transformed plant of claim 29.

31. A method to increase water stress resistance or tolerance in a monocot plant, comprising:

(a) introducing into cells of a monocot plant an expression cassette comprising a preselected DNA segment encoding an enzyme which catalyzes the synthesis of an osmoprotectant, operably linked to a promoter functional in the monocot plant cells, to yield transformed monocot plant cells; and

(b) regenerating a differentiated fertile plant from said transformed cells, wherein the enzyme encoded by the preselected DNA segment is expressed in the cells of the plant so as to render the transformed monocot plant substantially tolerant or resistant to a reduction in water availability that inhibits the growth of an untransformed monocot plant.

32. A transformed monocot plant, which plant is substantially tolerant or resistant to a reduction in water availability, the cells of which comprise a recombinant DNA segment comprising a preselected DNA segment encoding an enzyme which catalyzes the synthesis of an osmoprotectant, wherein the preselected DNA segment is present in the cells of the plant and wherein the enzyme encoded by the preselected DNA segment is expressed in an amount effective to confer tolerance or resistance to the transformed plant to a reduction in water availability that inhibits the growth of the corresponding untransformed plant.

33. The transformed plant of claim 32 wherein the transformed plant has an improved osmotic potential when the total water potential of the transformed plant approaches zero relative to the osmotic potential of a corresponding untransformed plant.

34. A method for altering the sugar content in a monocot plant, comprising:

(a) introducing into cells of a monocot plant an expression cassette comprising a preselected DNA segment encoding an enzyme which catalyzes the synthesis of a sugar, operably linked to a promoter functional in the plant cells, to yield transformed plant cells, and

(b) regenerating a differentiated fertile plant from said transformed plant cells, wherein the enzyme encoded by the preselected DNA segment is expressed in the cells of the differentiated plant in an amount effective to increase the sugar content in the cells of the differentiated plant relative to the sugar content in the cells of an untransformed plant.

35. The method according to claim 34 wherein the sugar is not detectable in the cells of the untransformed plant.

36. A transformed monocot plant having an altered sugar cellular content comprising a recombinant DNA segment comprising a preselected DNA segment encoding an enzyme which catalyzes the synthesis of a sugar, wherein the enzyme encoded by the preselected DNA segment is expressed in an amount effective to alter the sugar content of the cells of said plant.

37. The transformed plant of claim 36 wherein the sugar content of the leaves, seeds, or fruit of the cells of the transformed plant is greater than the sugar content of the leaves, seeds, or fruit of the cells of an untransformed plant.

38. A method for altering the mannitol content in a monocot plant, comprising:

(a) introducing into the cells of the monocot plant an expression cassette comprising a preselected DNA segment encoding an enzyme which catalyzes the synthesis of mannitol, operably linked to a promoter functional in the plant cell to yield transformed plant cells; and

(b) regenerating a differentiated fertile plant from said transformed plant cells, wherein the enzyme encoded by the preselected DNA segment is expressed in the cells of the differentiated plant in an amount effective to increase the mannitol content in the cells of the differentiated plant

relative to the mannitol content in the cells of an untransformed monocot plant.

39. The method according to claim 38 wherein the mannitol content of the transformed plant cells is greater than the mannitol content of the plant cells of step (a).

40. The method according to claim 38 wherein the mannitol content of the transformed plant cells during a reduction in water availability is at least about 1.1 to 50 times greater than the mannitol content in the transformed plant cells during water availability.

41. A transformed monocot plant having an altered mannitol cellular content comprising a recombinant DNA segment comprising a preselected DNA segment encoding an enzyme which catalyzes the synthesis of mannitol, wherein the enzyme encoded by the preselected DNA segment is expressed so as to alter the mannitol content of the cells of said plant.

42. The transformed plant of claim 41 wherein the mannitol content of the seeds, leaves or fruit of the transformed plant is greater than the mannitol content of the seeds, leaves, or fruit of an untransformed plant.

43. A fertile transgenic *Zea mays* plant comprising a recombinant DNA segment comprising a promoter operably linked to a first DNA segment encoding an enzyme which catalyzes the synthesis of an osmoprotectant, wherein the level of enzyme expressed from the first DNA segment in the cells of the transgenic *Zea mays* plant is substantially increased above the

level in the cells of a *Zea mays* plant which only differ from the cells of the transgenic *Zea mays* plant in which the recombinant DNA segment is absent, and wherein the recombinant DNA segment is transmitted through a complete normal sexual cycle of the transgenic plant to the next generation.

44. The fertile transgenic *Zea mays* plant of claim 43 wherein the recombinant DNA segment further comprises a second DNA segment encoding an amino terminal chloroplast transit peptide operably linked to the first DNA segment.

45. The fertile transgenic *Zea mays* plant of claim 43 wherein the osmoprotectant is a sugar.

46. A seed produced by the transgenic plant of claim 43.

47. A progeny transgenic *Zea mays* plant derived from the seed of claim 46.

48. A progeny transgenic *Zea mays* seed derived from the plant of claim 43.

49. A method to increase salt stress resistance or tolerance in a monocot plant, comprising:

(a) introducing into cells of a monocot plant an expression cassette comprising a preselected DNA segment encoding an enzyme which catalyzes the synthesis of an osmoprotectant, operably linked to a promoter functional in the monocot plant cells, to yield transformed monocot plant cells; and

(b) regenerating a differentiated fertile plant from said transformed cells, wherein the enzyme encoded by the preselected DNA segment is expressed in the cells of the plants so as to render the transformed monocot plant substantially tolerant or resistant to an amount of salt that inhibits the growth of an untransformed monocot plant.

50. A transformed monocot plant, which plant is substantially salt tolerant or resistant, the cells of which comprise a recombinant DNA segment comprising a preselected DNA segment encoding an enzyme which catalyzes the synthesis of an osmoprotectant, wherein the preselected DNA segment is present in the cells of the plant and wherein the enzyme encoded by the preselected DNA segment is expressed in an amount effective to confer tolerance or resistance to the transformed plant to an amount of salt that inhibits the growth of the corresponding untransformed plant.

51. The method according to claim 31, 34, 38, or 49 further comprising (c) obtaining progeny from said fertile plant of step (b), which comprise said preselected DNA segment.

52. The method according to claim 51 wherein said progeny are obtained by crossing said fertile plant of step (b) with an inbred line.

53. The method according to claim 51 comprising obtaining seed from said progeny and obtaining further progeny plants comprising said preselected DNA segment from said seed.

54. The method according to claim 53 wherein seeds are obtained from said further progeny plants and plants comprising said preselected DNA segment are recovered from said seed.

55. The method according to claim 52 comprising obtaining seed from said progeny and obtaining further progeny plants comprising said preselected DNA segment from said seed.

56. The method according to claim 55 wherein seeds are obtained from said further progeny plants and plants comprising said preselected DNA segment are recovered from said seed.

57. The method according to claim 52 wherein the progeny obtained in step (c) are crossed back to the inbred line, to obtain further progeny which comprise said preselected DNA segment.

58. The method according to claim 57 wherein said further progeny are crossed back to the inbred line to obtain progeny which comprise said preselected DNA segment.

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